M2 HIDROBOYA™ SAMPLING PLATFORM: DEVELOPMENT OF A PHYSICAL AND OPERATIONAL CAPABILITIES SIMULATOR

Xulio Fernández-Hermida[1], Manuel Vázquez Enríquez[15], Fernando Martín-Rodríguez[16]

Abstract

Hidroboya [1] (or Hidro-Buoy) is a new platform for water monitorization that introduces a new concept: keeping sensors dry and away from water inside an internal chamber that is filled with fresh water when necessary. This paper describes a Simulator of the Hidroboya Sampling Platform. Hidroboya Sampling Platform can be compared to the systems used to perform blood analysis where some samples of blood are taken out of our veins and are moved to a place where they can be analyzed in the best conditions for the sensors that perform the analysis. Traditional methods do not sample water and only sample data. In doing this the sensors get fouled in a few weeks and the data they feed become erroneous.

The Hidroboya Sampling Platform Simulator has been done to help researchers understand the actual behaviour of water when going up to the Measuring container and the air consumption when putting it back down in its sampling point.

Keywords - buoy, marine sensors, fouling, physical simulation, computer graphics.

I. INTRODUCTION

Here, we will remember slightly the general overview for Hidroboya [1]: buoy main part is a strong hosepipe hanging from a floating body. The hose contains several sampling catheters which are used to get water from different depths (as these tubes go out from the main hose and finish at the desired sampling depths). The main hose is securely bound to the anchoring chain in one or more points to avoid excessive hose movement.

The sampled water will go through a "sampling chamber" located inside the floating body. Sensors inside the chamber will get the desired data. As we are keeping sensors away from sea water (or sweet water) most of the time we get a "fouling free" buoy.

II.HIDROBOYA SIMULATION

During Hidroboya development, we decided to create a graphic Hidroboya simulator that nowadays is a standalone software product. Simulator has been built in Java around a graphic interface developed using QT Jambi [2] (a Java version of the well-known QT graphic library for C++). In figure 1, we see a snapshot of the simulator showing a Hidroboya scheme over which we can interact to learn Hidroboya working or in order to get other purposes.

Utilities of this simulator are much greater than we thought at first, for example, we can list the following:

Knowing and learning of Hidroboya working. This can serve as a commercial tool for potential users and also as a training tool for users responsible for configuring and/or operating Hidroboya systems. For example, using this simulator we can determine an optimal configuration for measuring instants on the different catheters.

The simulator is able to communicate with a real (hardware) Hidroboya control board using a RS-232 interface (or a USB/RS-232 adaptor as most pc's do not have RS-232 ports nowadays). This makes the simulator to become an "emulator" (Id EST: it is emulating the real buoy in a manner that the board is not able to distinguish it). This is useful to test a board that has just been assembled and also to test hardware/software changes on board design.

As the simulator allows defining all the working parameters of a buoy: number and length of catheters, electro-valves and compressor parameters, peristaltic bomb... our simulator can be used to design buoys for practical installations.

Although the graphic engine is the central part of the simulator (and it was the first part to be implemented), code is well structured into three main modules. These modules are the following: graphic engine (responsible for representing the buoy and interacting with user), physical simulator (responsible to compute water movements according to fluid physics) and communications with the control board (in this case it is not the user who interacts with compressor and electro-valves but an automatic control board).

We want to emphasize the fact that water ascent into the catheters is simulated using the Hagen–Poiseuille equation (catheter is full of pressurized air which suddenly drops to normal pressure), which in this case yields a differential equation: where x(t) is the water level. Afterwards we simulate the working of a peristaltic bomb used to continue the chamber filling when the chamber is located over the level of the water, what was the situation in the primarily versions of the Hidroboya..

III.CONCLUSIONS

In this paper we describe the development of a Hidroboya simulator as a parallel product, designed to help in Hidroboya workings. Simulator began by being a small auxiliary application by due to its adaptability has become a major utility that can contribute greatly in all Hidroboya processes. Simulator development and growing has undergone the same processes and milestones of Hidroboya development.

REFERENCES

[1] Fernández, X. et al, Hidroboya: A Completely New Way of Overcoming the Fouling Problem in Marine Sensors, Martech-2011 (Cádiz, Spain), 2011.

[2] http://qt-jambi.org/

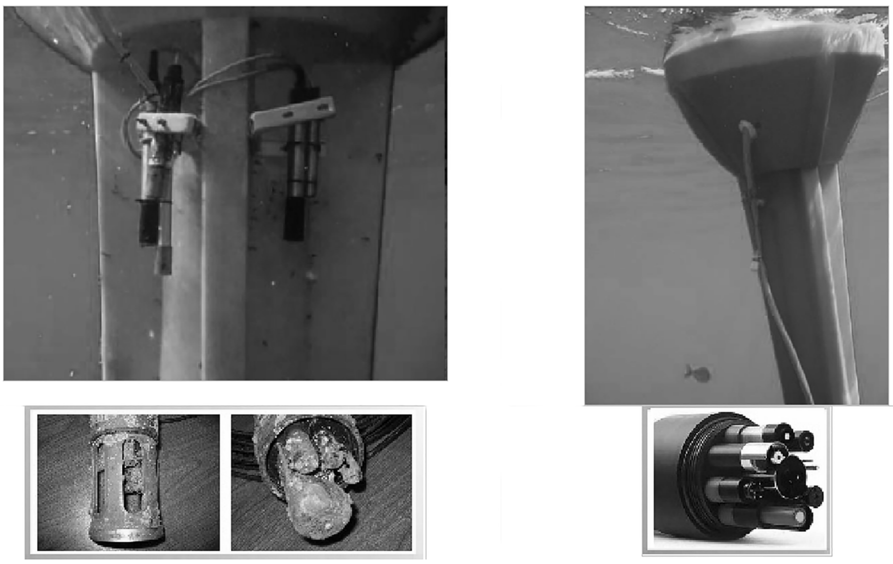

Figure 1. Left: sensor arrangement in a classical buoy (above), sensors become fouled, right: Hidroboya (above), clean sensors (below).

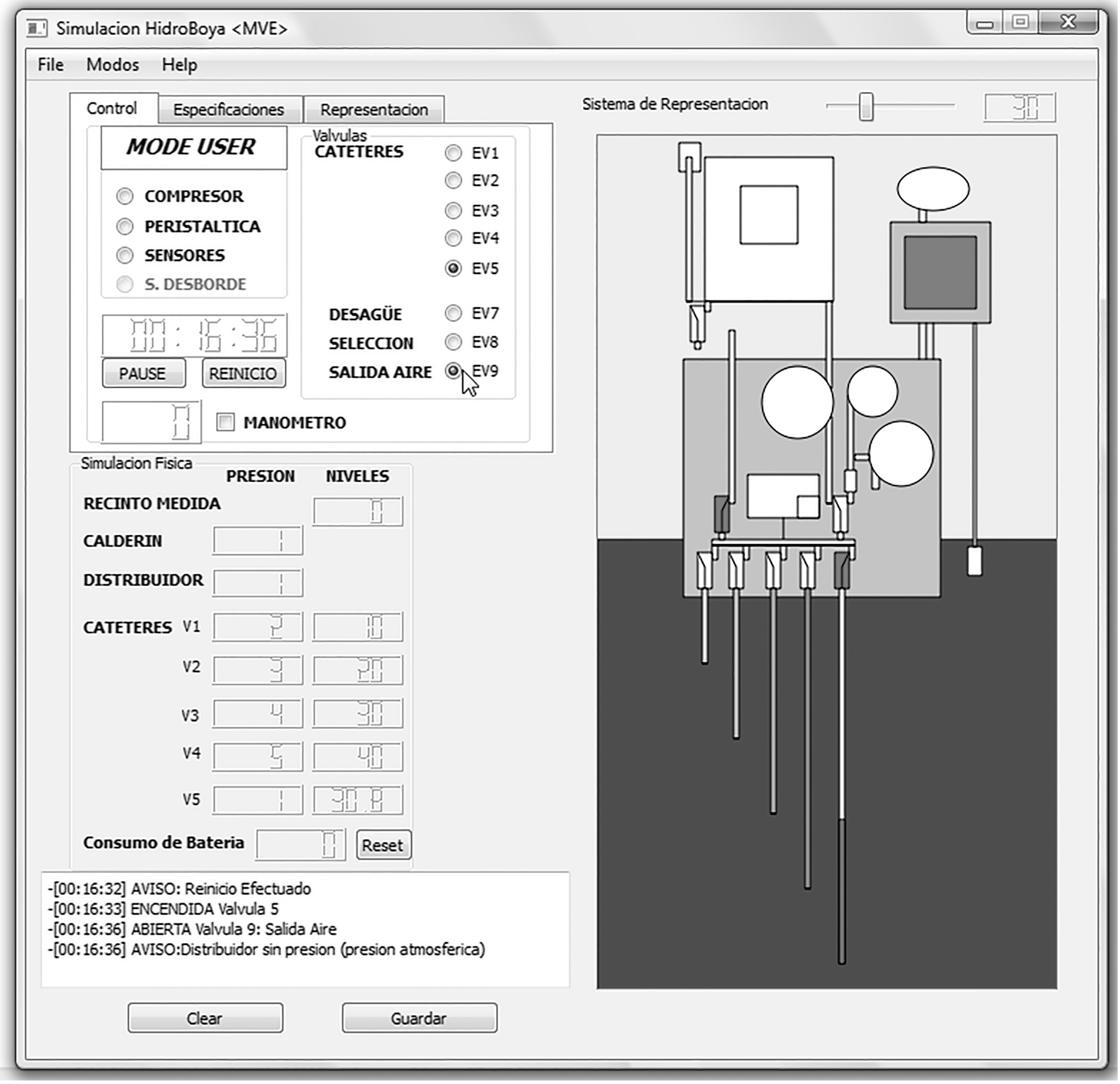

Figure 2: Graphic representation of the simulation.